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AUTHOR Frazier, Lavon
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ABSTRACT

Washington State University developed a comprehensive supplies inventory system and a generalized billing system with multiple users in mind. The supplies inventory control system developed for Central Stores, a self-sustaining service center that purchases and warehouses office, laboratory, and hardware supplies, was called AIMS, An Inventory Management System. Its major components include four online transaction processing functions, two online file maintenance functions, and two online inquiries. The most frequently used online transaction is sales processing. Batch processing is limited to a monthly reconciliation procedure, printing of the catalog, and operational and management reporting. The Service Center Billing System consists of special charge processing, which is online, along with file maintenance, file inquiry, special purpose online functions, and batch processing. Currently 14 campus service units are using these online database systems, and have realized better inventory management, improved customer service, and faster revenue return. Eliminating paper flow from these units to the central accounting office has greatly reduced the office's workload. Benefits of these two systems have extended to service unit customers. With video terminals, departments across campus can check inventory availability and current prices, place their own orders electronically, and receive next-day delivery of supplies. (SW)

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# Inventory and Billing Systems for Multiple Users

Lavon Frazier

University Computing Services
Washington State University
Pullman, Washington 99163-1230

## Abstract

Washington State University developed a comprehensive supplies inventory system and a generalized billing system with multiple users in mind. Currently, 14 campus service units are using these on-line database systems, and have realized better inventory management, improved customer service, and faster revenue return. Eliminating paper flow from these units to the central accounting office has greatly reduced accounting's workload. Now the benefits of these two systems have been extended to the service units' customers themselves. With video terminals, departments across campus can check inventory availability and current prices, place their own orders electronically, and receive next-day delivery of supplies.

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# Inventory and Billing Systems for Multiple Users

## Washington State University Database

In the fall of 1978, Washington State University initiated a plan to integrate administrative information processing using an online database approach. Work began to identify the data being processed within the university, either by automated or manual means. Administrative functions were analyzed and charted without regard for organizational boundaries. The result was a clear picture of data and activities to be integrated into a university information system.

Some of the functions studied in this process were already served by automated data processing. A few of these were online systems, but most were independent batch systems and near the end of their useful life. Many of the functions were handled completely by manual procedures without the benefit of automated processing. The strategy which was adopted to gain the most benefits in the shortest amount of time was to concentrate effort on the "data feeder" systems. That is, automate and integrate the areas which collected or prepared the data that was fed into central processing systems such as accounting or student records.[1]

## Inventory and Billing Requirements

At this same time, an effort was undertaken to automate the inventory control and billing functions at the university's largest storeroom operation, Central Stores. Central Stores is a self-sustaining service center which purchases and warehouses office, laboratory, and hardware supplies. It serves the entire Washington State University campus and outlying units, as well as local governmental agencies and the nearby University of Idaho.

The Central Stores inventory was being processed entirely by hand. Items were removed from inventory and delivered to customers before the manual inventory records were updated. Prices and totals were written onto the multi-part order form and a copy forwarded to the central accounting office. There the forms were reviewed and coding corrections made. After key-entry and a preliminary batch-edit process, the transactions were ready for the accounting system. However, if errors had been detected, the transactions would wait for someone with the time to investigate. It may have been weeks later that the problem was resolved and the transactions processed through the accounting system. Then on the next monthly Budget Statement the customer departments first knew how much they had been charged for supplies, and on the following Budget Statement, Central Stores would see a credit for that revenue.

[1] Jack Steingraber and Doug Kunkel, "An Integrated University On-Line/Data Base System: A Reality", Proceedings of the 1981 CAUSE National Conference, 1981, p. 227.

The Central Stores operation clearly performed a "data-feeder" function. And it was similar to other service centers which also fed interdepartmental transfer and accounts receivable transactions into the accounting system. There were also several other units on campus which kept specialized inventories and that had inventory control problems much the same as Central Stores. It was apparent that the inventory and billing systems needed by Central Stores were good candidates to be designed and integrated with the university database.

A Preliminary Requirements Study for automating the inventory and billing functions at Central Stores and other university units was done in the fall of 1978. Units that were interviewed included Central Stores, Duplicating and Mailing, Surplus Stores, Equipment Repair Service, Purchasing, Receiving and Delivery, Housing and Food Service, Physical Plant, Motor Pool, Accounts Payable, and General Accounting. The study results confirmed that several units could benefit from a comprehensive inventory system and additional units would benefit from a generalized billing system as well. A Cost/Savings/Benefit Analysis presented several alternatives for Central Stores, and it was decided to proceed with systems development using the main campus computer and the university database. With this approach, other service centers would be able to share in the use of the systems.

## An Inventory Management System (AIMS)

The comprehensive supplies inventory control system developed for Central Stores is called AIMS, An Inventory Management System. Its major components include four online transaction processing functions, two online file maintenance functions, and two online inquires. These, along with other system components, are listed in Table 1. The online transaction processing functions are used daily, and allow database inventory records to accurately reflect inventory on the shelf. There are no batch transaction processors. Batch processing is limited to a monthly reconciliation procedure, printing of the catalog, and operational and management reporting.

The most frequently used online transaction is Sales Processing. It performs a billing function as well as processing inventory information. An initial data entry screen accepts the customer's requisition number to be billed, the date of the transaction (if not today), and messages or customer references for the picking/packing slip. This screen also provides links to two other database systems, the Project Management System and the Planned Maintenance System, which allow the posting of inventoried materials charges to both projects and pieces of equipment. After the initial data has been entered, a billing validation screen is returned. Then a repeating screen allows the entry of up to 10 inventory items at a time, requiring only the item number and quantity being sold. For each one of these screens used, a verification/error screen returns showing the results of those entries. The terminal operator has an opportunity to void any entry at this point. When the entries have been verified, inventory records are automatically posted, the customer's requisition balance is updated, and transactions are created for audit purposes and to feed into the accounting system. When the sale is complete, a picking/packing slip is automatically printed on the service center's online printer, and the order is filled.

Table 1. An Inventory Management System (AIMS).

Online Functions

Sales Processing
Receiving Report Processing
Physical Inventory Count Entry
Order Entry

Item Description File Maintenance
Supplies Inventory File Maintenance
Item Description File Inquiry
Supplies Inventory File Inquiry

Item Sales History Inquiry
Item Transaction List Inquiry
Order Group Average
Receiving Report Error Fix

Batch Reporting

Catalog Select, Sort, and Print
Inventory Exception Report
Inventory Monthly Reconciliation and Totals
Inventory Ordering Forms
Inventory Proof List
Inventory Valuation Report
Physical Inventory Forms
Shelf Labels
Transaction History Report

The other major online transaction processors function in a similar manner. An initial data entry screen accepts some general information, then a repeating screen allows the entry of up to 10 inventory items at a time. Verification/error information is returned, and the terminal operator may void any entry. When the entries have been verified, inventory records are posted, and audit transactions are generated.

Each of the transaction processors, however, has a different purpose. Receiving Report Processing is used to add more stock to the inventory. It calculates new prices for items based on the algorithm for that service center. Physical Inventory Count Entry adjusts the inventory when a physical count is taken and some discrepancies found. It accumulates the total dollar value of the shortage or overage, as well as generating the detail audit transactions. The Order Entry function is used when it is necessary to replenish inventory supplies. It collects information for an order attachment which is later printed online and forwarded to the Purchasing Office. There it is attached to a purchase order and sent to the vendor. One copy is kept at the inventory site to be used as a receiving report.

The two online maintenance functions and two online inquiries are used to add, change, or display information from two database files. One file, the Item Description File, contains general information about each inventory item. It has the detailed item description needed to print on an order attachment. It also has other purchasing information that will be used when an online purchasing system is implemented on the database. The second file is the Supplies File, which contains one record for each item in each service center's inventory. It should be noted that the quantity-on-hand or cost of an item in the Supplies File cannot be changed with the file maintenance program. Changes to those data elements are only made with the online transaction processors so that an adequate audit trail is kept.

The remaining online functions serve special purposes. The first inquiry is an Item Sales History, showing the monthly sales totals for an item over the past two years, with a three, six, and twelve month average for reorder purposes. The second inquiry is an Item Transaction List which displays the recent transactions for an item, including sales, receiving reports, and physical inventory counts. Order Group Average is used to average together the cost of a group of items in order to arrive at a common selling price, e.g., felt-tip pens, where new stock of some colors is received at a higher cost than old stock and would otherwise result in a higher selling price for those colors. The final online function, Receiving Report Error Fix, allows the back-out of a receiving report entered incorrectly which resulted in an error in price calculation.

## Service Center Billing System

The generalized Service Center Billing System implemented for Central Stores is comprised of a single online transaction processing function, one online file maintenance function, one online file inquiry, and several special purpose online functions (see Table 2). Batch processing is limited to preparing transactions for the accounting system and printing operational and management reports.

The online transaction, Special Charge Processing, is used to bill any and all charges to customers. It handles charges for labor and benefits, equipment usage, subcontract work, and non-inventoried materials (note that inventoried materials are billed through Sales Processing in AIMS). The initial data entry screen is identical to the initial screen in Sales Processing. It also links to the database Project Management and Planned Maintenance Systems, posting charges to both projects and equipment. After a validation screen is returned, a repeating screen allows entry of the detail for each charge. Additional data elements on this screen provide a link to the Property Inventory System, accruing income to a piece of equipment when its use is billed out to a customer. A verification/error screen returns for the charge, and the terminal operator may void it at this time. All verified charges are reflected by an update of the customer's requisition balance, and transactions are created for the dual purpose of audit and feeding into the accounting system. When the charge processing is complete, a charge slip is automatically printed on the online printer, if the service center has chosen this option.

Table 2. Service Center Billing System.

| Online Functions |
|---|
| Special Charge Processing |
| Requisition File Maintenance |
| Requisition File Inquiry |
| Special Charge Transaction List |
| Transaction File Look |
| Packing/Charge Slip Message |
| Requisition Change to New Fiscal Year |
| Requisition Fix to be Reopened |
| **Batch Processing and Reporting** |
| Daily Billing with Service Center Totals |
| Monthly Billing with Service Center Totals |
| Monthly Consolidated Invoices |
| Requisition List |
| Requisition Purge Report |

The online file maintenance function is used to change data on the Requisition File which holds the billing information for each customer. If interdepartmental requisitions are set up with an initial dollar amount, then that amount is encumbered in the central accounting system. This encumbrance may be split among as many as 10 accounts numbers. (As expenditures are accrued to these accounts through Special Charge Processing or Sales Processing, corresponding amounts are liquidated from the encumbrance.) Additional funds may be entered at any time. Beside a dollars spent (or overspent) limit, the requisition may be restricted to a specific time period, to a single classification of expense, and/or to a limited number of named people who are authorized to do business. Any of these restrictions, as well as other informational or accounting data, may be changed with the file maintenance function. Similarly, all the restrictions, informational, and accounting data are displayed with the online inquiry function.

There are five special purpose online functions included in the billing system. The first is Special Charge Transaction List, an inquiry to the service center's special charge transaction records within a specified period of time. The second, Transaction File Look, presents more detailed information from transaction records. These can be selected by date created, date effective, requisition number charged, invoice number, item inventory number, or a single transaction's internal sequence number. The Packing/Charge Slip Message function allows a service center to include a standard message on all its printed slips, and to change that message whenever desired. The Requisition Change to New Fiscal Year function is used to renew a requisition for another year with a new balance. The final function, Requisition Fix to be Reopened, is used to clear any previous overexpenditure on a closed requisition that is to be reopened with additional funds.

The batch processing and reporting functions of the Service Center Billing System warrant some explanation also. Transactions that result from Special Charge Processing and Sales Processing are prepared daily for input to the central accounting system. These transactions represent encumbrances, liquidations of encumbrances, accruals of expense, and accounts receivable charges. Totals are accumulated by online function and transaction type for each service center, and are printed either at the service center's online printer or at a central site for distribution. Monthly billing procedures include the reversal of accruals and preparation of the actual disbursements, with a reconciliation of transactions to the Requisition File and the printing of totals for each service center. Monthly invoices recap all detail transactions for the month on each requisition that the customer has with any of the service centers participating in the billing system.

Several references have been made to multiple service centers within the Service Center Billing System. It is apparent that the original plan of developing a system for Central Stores and implementing it for other service units has been successful. New users have been added to both the inventory and billing systems with very few modifications. There are currently 14 university service centers which use one or both of these systems. Their names and principle service functions are listed in Table 3.

Table 3. Service Center Billing System Users.

| Service Center | Function |
|---|---|
| *Alcohol Stores | Laboratory alcohol supplies |
| *Central Stores | Office, laboratory, hardware supplies |
| College of Engineering | Photo, machine, design shops |
| College of Pharmacy | Pharmaceutical supplies |
| Heavy Equipment | Heavy equipment rental and repair |
| Instructional Media Services | Media production, rental, repair |
| Mailing Services | Mailing and postage |
| Motor Pool | Fleet vehicles rental and repair |
| Physical Plant | Maintenance and construction |
| *Physical Plant Storeroom | Construction, maintenance supplies |
| Publications and Printing | Duplicating and printing services |
| Technical Services | Electronics, glass, instrument, graphics shops |
| University Computing Services | Automated administrative systems |
| Vivarium | Research animal care |

*also users of An Inventory Management System.

## System Benefits

The university has gained a great deal from An Inventory Management System and the Service Center Billing System. Design of the systems to function for multiple users has been successful beyond expectations. Use of the central database has allowed integration with more recently developed systems, notably Project Management, Planned Maintenance, and Property Inventory. A total of 42 specific benefits were listed in the Cost/Savings/Benefit Analysis document, and nearly all of them have been realized.

Inventory system users have better inventory management with accurate and timely inquiries and reports. Detailed data on each item and item sales history is available online. Audit transactions provide sales, receipts, overages, and shortages for every item. Automated re-order points and ordering tools improve ordering procedures and reduce the number of items out of stock. The standardized selling price calculation along with consistency in other procedures increase employee efficiency. Online inquiries replace going out into the warehouse to answer questions and to check on items. The inventory system eliminates the need for a service center to spend weeks in assembling and printing a catalog, or days being closed for business to take a physical inventory, or hours preparing month-end financial reports.

For billing system users, the benefits are equally valuable. The service center is able to provide more monitoring and control functions for its customers. Non-university customers are billed as easily as university departments. Special indicators allow tracking and reconciliation of cash sales. Priced packing/charge slips, monthly detailed invoices, and prompt billing through the central accounting system improve service to all customers. The customer always knows how much has been charged, and the service center knows when it will receive credit for the revenue. Information is available to both of them for a more accurate financial picture.

The fact that the billing for 14 service centers is done automatically means a drastic reduction in workload in the central accounting area. There is no longer a need for handling paper, editing, totaling, adding account codes, batching for data-entry, running pre-edit checks, and correcting errors. All these functions are done online and in the daily billing process. Recent estimates put the reduction in workload at 70% of the interdepartmental requisition processing. As a result, the central accounting area is actively pursuing its own use of the billing system to process the remaining interdepartmental workload.

## Direct Customer Orders

Now there is an extension of the inventory and billing systems that affords significant additional benefits. That is putting these systems into the hands of the end users, the customer departments themselves! Because these systems are integrated into the central university database, departments with video terminals are able to check the Central Stores inventory and place their own orders for supplies electronically.

There are two basic functions which support the departments in placing direct orders. One is a limited inquiry capability which accepts an item number and displays back the description of the item, selling unit(s) and price(s), quantity on hand, quantity on order from the vendor, and date of the last vendor order. The second function is Sales Processing. With the added restrictions of accessing only appropriate requisitions and of disallowing price adjustments and credits, the customer uses the same Sales Processing function that would be used if the order were mailed to Central Stores and entered into the system there.

The benefits of direct orders are a gain in time and efficiency. The customer spends about the same amount of time at a terminal as would have been spent typing the order. But now the availability (or backorder) of stock items is known when the order is placed. The cost for the order and the new requisition balance are also immediately available. The picking/packing slip automatically prints at Central Stores identifying which terminal originated the order, and the order is filled. The electronic transmittal alone cuts out a two to four day delay caused by sending the order through the campus mail system. The result is a dramatic improvement in service, from a four or five day wait to next-day delivery!

Departments currently ordering directly from Central Stores include all the service centers using the Service Center Billing System, plus departments in the College of Agriculture, the Office of Systems and Computing, and nearly all of the central administrative offices. As the terminal network expands rapidly across the campus, more departments will be able to take advantage of this direct ordering capability. The unique multi-user system design and the central integrated database combine to allow the benefits of both An Inventory Management System and the Service Center Billing System to be extended to all university departments.